Confessions of a Control Freak

I can strongly support the statements of Andy Pearson, Ph.D., C.Eng., Fellow ASHRAE, in the July issue regarding the danger of overcomplicating refrigeration systems by using too many (or too sophisticated) control apparatuses.

I had the privilege of receiving vocational training as a refrigeration technician and learning on the job for three years. So I got the opportunity to gather practical experience before becoming a professional refrigeration engineer with an university degree.

One of my first jobs as a young engineer was to rehabilitate a complex refrigeration system full of control elements. To use the expression of the author, it was severely "hunting." So I drastically reduced the number of controls, with the result that the system was not so "sophisticated" anymore, but was functioning to the full satisfaction of the owners.

This happened in 1964! At the end of the day, the most important thing is that the operating and maintenance staff understands the system and can adjust it if the need exists. Already in those years it happened time and again that systems were operated by hand by experienced staff.

During my long professional life, I would witness the introduction of more and more electronic control elements, often used too extensively, complicating refrigeration plants unnecessarily. The main reason for that was "energy saving." The result: malfunctioning systems. In those cases no energy saving exists; on the contrary, energy is wasted because systems are not operating properly.

I encourage my younger colleagues to perhaps take a small step back to the roots and to design plants as simply as possible and feasible.

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- From July's "Confessions of a Control Freak," by Andy Pearson, Ph.D., C.Eng., Fellow ASHRAE, regarding cooling systems with multiple capacity stages that "hunt," in addition to increasing the stage delay time, one should also consider the cooling demand side. If this is driven by a PI algorithm, this often increases the cooling stage demand to achieve zero "offset error" (error from setpoint) in the steady state. In a direct-expansion (DX) HVAC system for example, this may oscillate a cooling stage to negate a trivial (e.g., <0.5°C) error in the room temperature. It's better to use simple proportional control for demand and live with small steady-state offset errors and stable stage operation.

Regarding derivative action, your "wise old hand" is right: don't use it. It is highly susceptible to measurement noise, and, worst of all, very few HVAC engineers understand it. That means it will get overridden.

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Airborne Disease Transmission Risk

We read "Airborne Disease Transmission Risk and Energy Impact of HVAC Mitigation Strategies" by Michael J. Risbeck, Ph.D., et al., from May with great interest, and we agree that ventilation is a costly source of achieving adequate equivalent outdoor air (EOA) supply. However, the cost of operating ventilation systems for reducing infection risk is much lower than the cost of taking care of a large number of infected patients.[1] Overloading the health-care system is a painful lesson learned in many places. Many fragile elderly people in Hong Kong lost their lives in February 2022 during the Omicron wave.

Additional EOA supply should be considered in crowded places, including public transport vehicles and airplanes, for reducing the infection risk, on top of the ASHRAE minimum outdoor air to handle CO_2 levels.

As it is difficult to measure ventilation rates quickly and accurately, a control scheme is proposed[2] on installing meters to record the mechanical ventilation energy E consumed; and appropriate sensors for checking the CO_2 level C to judge whether the ventilation rate is adequate, say 6 ACH. A control parameter expressed as a function f(E,C) should be proposed and monitored by the facility management office.

The scientific principle of ventilation is then transferred to the building services engineering practice, which can be monitored by facility management to work out operational schemes under the current COVID-19 epidemic.

References

1. Chow, W.K., C.L. Chow. 2022. "Modelling lockdown effects on controlling the spread of COVID-19." medR$_x$iv. Preprint. https://doi.org/10.1101/2022.06.04.22275993

2. W.K. Chow. 2022. "Ventilation requirements and recommendations for controlling SARS-CoV-2 and variants outbreaks in indoor gathering places with close contact" medR$_x$iv. Preprint. https://doi.org/10.1101/2022.06.15.22276447 ■